

<b>KEC</b>	<b>KEC INTERNATIONAL LTD., JABALPUR</b>	SECTION	QPM/QA/20
	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 1 of 22

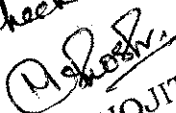
<b>TITLE :</b>	<b>MANUFACTURING QUALITY PLAN</b>
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Sl No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
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1.	<b>RAW MATERIAL INDIGENOUS</b>				
1.1.	<b>STRUCTURAL STEEL (ANGLE SECTIONS &amp; PLATES)</b>				Steel as per IS 2062 to be procured from main producers, i.e. SAIL, TISCO, IISCO, Lloyds, Rasht-riya Ispat Nigam or Re-Rollers through main producers and CESC approved sources. For re-rollers specific approval of CESC is to be ensured if required as per contract for Direct Purchase.
1.1.1	<b>PHYSICAL PROPERTIES</b>				
(a)	Test for ultimate Tensile Strength	One sample for 50 MT or part thereof as per IS 2062	IS 2062 Grade E250A/BR/B0 E350	QA (KEC)	Verification of Manufacturers Test Certificates.
(b)	Test for Yield Stress	One sample for 50 MT or part thereof as per IS 2062	IS 2062 Grade E250A/BR/B0 E350	QA (KEC)	Verification of Manufacturers Test Certificates.
(c)	Percentage Elongation Test	One sample for 50 MT or part thereof as per IS 2062	IS 2062 Grade E250A/BR/B0 E350	QA (KEC)	Verification of Manufacturers Test Certificates.
(d)	Bend Test	One sample for 50 MT or part thereof as per IS 2062	IS 2062 Grade E250A/BR/B0 E350 Pieces at room temp. shall withstand bending through 180° To an internal dia not greater for Dia ≤ 25 mm - 2t for Dia > 25mm-3t, with both side parallel without	QA (KEC)	Verification of Manufacturers Test Certificates.

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	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	Sheet No.	Page 2 of 22

TITLE : MANUFACTURING QUALITY PLAN

Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
1.1.2	CHEMICAL COMPOSITION	One sample for 50 MT or part thereof as per IS 2062	IS 2062	Main Producers Works/ QA (KEC)/ Thi-rd Party Independent Lab.	Verification of Manufacturers Test Certificates.
1.1.3	VISUAL CHECKS FOR SURFACE FINISH	IS 2500 - Level - II AQL -1.5 as per table - I enclosed.	IS 2062 Material to be free from surface flaws, lamination, rough / Jagged Edge and imp-erfect edges, cracks, rounded apex, deep roll marks, pipy and any harmful defects.	RY (KEC)	Record Review (Removal of minor surface defects as per IS 2062 Clause-7
1.1.4	DIMENSIONAL CHECKS INCLUDING ROOT RADIUS	Same as 1.1.3.	IS 808	RY (KEC)	Record Review
1.1.5	TOLERANCE FOR LEG LENGTH OF ANGLES :	Same as 1.1.3	IS 1852	RY (KEC)	Record Review
(a)	EQUAL ANGLES :				
(i)	Upto 45 mm Leg Length	Same as 1.1.3	$\pm 1.5$ mm	RY (KEC)	Record Review

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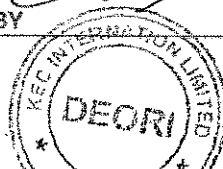
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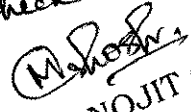
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	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 3 of 22

<b>TITLE :</b>	<b>MANUFACTURING QUALITY PLAN</b>
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Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
(ii)	> 45 to 100 mm Leg Length	Same as 1.1.3	$\pm 2.0$ mm	RY (KEC)	Record Review
(iii)	> 100 mm Leg Length	Same as 1.1.3	$\pm 2.0$ % of Leg Length Difference between the leg length of equal angles shall be limited to 75% of total tolerance (plus & minus) specified on the leg length.	RY (KEC)	Record Review
(b)	UNEQUAL ANGLES :				
	Short Leg Length	Same as 1.1.3	$\pm 1.5$ mm	RY (KEC)	Record Review
	Long Leg Length		+ 2.0 mm / -1.5 mm		
1.1.6	OUT OF SQUARENESS	Same as 1.1.3	IS 1852, $\pm 1^\circ$	RY (KEC)	Record Review
1.1.7	CAMBER				
(i)	For flange less than 100mm	Same as 1.1.3	IS 1852, Max 0.02% of length.	RY (KEC)	Record Review
(ii)	For flange 100 mm and above	Same as 1.1.3	Max. 0.2% of length	RY (KEC)	Record Review
1.1.8	Weight Tolerance for Angle Sections	One sample for 20 MT per section or part thereof	IS 1852, IS 808 Upto 3mm thick $\pm 5\%$ > 3 mm thick + 5%, - 3% over weights specified in IS 808.	QA (KEC)	Record Review
1.1.9	Weight Tolerance for Plates	One sample for 20 MT per section or part thereof	IS 1852, IS 1730 + 5 %, - 2.5 % Over weight specified in IS 1730.	QA (KEC)	Record Review

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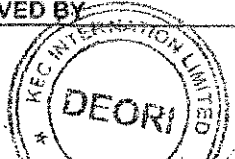
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	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
		SHEET NO.	Page 4 of 22
	<b>CUSTOMER-CESC</b>		

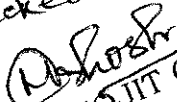
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Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
1.1.10	Thickness Tolerance for Plates	Same as 1.1.3	IS 2062, IS 8500 IS 1730, IS 1852. < 8 mm thick + 12.5 %, - 5.0 % 8 mm to 12 mm + 7.5 %, - 5.0 % Over 12 mm $\pm$ 5.0 %	RY (KEC)	Record Review
1.2	<b>ZINC (To be procured from HZL or Imported )</b>				
1.2.1	CHEMICAL COMPOSITION	One sample for 50 MT or as per CESC's specification which ever is less.	IS 209 - 99.95 %,	KEC/ Third party Independent Lab.	Verification of Manufacturers Test Certificates.
		One sample every month from Bath.	IS 209 - 98.50 %		
1.3	<b>LEAD (To be procured from HZL or Imported )</b>				
1.3.1	CHEMICAL COMPOSITION	One sample for 100 MT	IS 3717 Grade : As per P.O.	KEC/Th ird party Independent Lab.	Verification of Manufacturers Test Certificates.
1A	<b>RAW MATERIALS (IMPORTED)</b>				
1A.1	<b>STRUCTURAL STEEL</b>				
1A.1.1	PHYSICAL PROPERTIES				
( a )	Test for Ultimate Tensile Strength	One sample for 20 MT per section per lot or part thereof , one sample for 40MT/sec/cast/or part there of as per BSEN 10025	BSEN 10025	QA (KEC)	Verification of Manufacturers Test Certificates.

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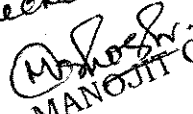
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		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 5 of 22

TITLE :	MANUFACTURING QUALITY PLAN
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Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
(b)	Test for Yield Stress	One sample for 50 MT or part thereof as per JIS G 3101 One sample for 40 MT or part thereof as per DIN 17100 / ASTM - A36 / A572 One sample for 20 MT per section per lot or part thereof , one sample for 40MT/sec/cast/or part there of as per BSEN 10025	JIS G 3101 DIN 17100 ASTM- A36 / A36M A572/A572M-Gr.50 BSEN 10025	QA (KEC)	Verification of Manufacturers Test Certificates.
(c)	Percentage Elongation Test	One sample for 50 MT or part thereof as per JIS G 3101 One sample for 40 MT or part thereof as per DIN 17100 / ASTM - A 36 / A 572 One sample for 20 MT per section per lot or part thereof , one sample for 40MT/sec/cast/or part there of as per BSEN 10025	JIS G 3101 DIN 17100 ASTM - A36/A36M A 572/A572M BSEN 10025	QA (KEC)	Verification of Manufacturers Test Certificates.
(d)	Bend Test	One sample for 50 MT or part thereof as per JIS G 3101 One sample for 40 MT or part thereof as per DIN 17100 / ASTM - A 36 / A 572 One sample for 20 MT or part thereof as per DIN 17100 One sample for 40 MT or	JIS G 3101 DIN 17100 ASTM - A36/A36M A 572/A572M Not required for steel as per BSEN 10025 DIN 17100 Bend Test 180°	QA (KEC)	Verification of Manufacturers Test Certificates.

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		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 6 of 22

<b>TITLE :</b> MANUFACTURING QUALITY PLAN
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		part thereof as per ASTM and KEC Specification.	ASTM – A6/6M Grade A36/A36M Bend Test – 180° Grade A572/A572M Bend Test – 180°		
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**NOTE:** For Acceptance Norms refer Table -2 for Chemical Properties and Table -3 for Mechanical Properties.

		One sample for 50 MT or part thereof as per JIS G 3101	JIS G 3101 Sample shall withstand bending through 180° to an internal dia. Not > 2t with both sides parallel with out cracking.		
(e)	Minimum Charpy 'V' Notch Impact Test For BSEN 10025 Grade S 355 JO	One, sample for 20 MT per section per lot or part thereof , one sample for 40MT/sec/cast/or part there of as per BSEN 10025	BSEN 10025 for acceptable norms, please refer Table – 3, enclosed.	KEC/Third party Independent Lab.	Verification of Manufacturers Test Certificates.
1A.1. 2	CHEMICAL COMPOSITION	One sample for 40 MT or part thereof as per BSEN 10025 / JIS G 3101 / DIN 17100 / ASTM – A36 / A572.	BSEN 10025 JIS G 3101 / DIN 17100 / ASTM – A36 / A572.	QA / Third Party Lab. / Manufacturer T.C.	Verification of Manufacturers Test Certificates.
1A.1. 3	VISUAL CHECKS	IS 2500 LEVEL – II, AQL – 1.5 as per Table – I enclosed.	BSEN 10025 / JIS G 3101/ ASTM A6 / DIN 17100	RY (KEC)	Record Review.
1A.1. 4	DIMENSIONAL CHECKS (Including Root Radius)	IS 2500 LEVEL – II, AQL – 1.5 as per Table – I enclosed.	BSEN. 10056-1 , JIS G 3101 / ASTM A6 / DIN 1028 & 1029	RY (KEC)	Record Review.
1A.1.	TOLERANCES FOR	IS 2500 LEVEL – II,	BS 10056-2	RY	Record Review

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		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 7 of 22

TITLE : MANUFACTURING QUALITY PLAN

Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
5	LEG LENGTH	AQL – 1.5 as per Table – 1 enclosed.	<p>Leg Length up to 50 mm, <math>\pm 1</math> mm</p> <p>&gt; 50 to <math>\leq 100</math> mm <math>\pm 2</math> mm</p> <p>&gt; 100 to <math>\leq 150</math> mm <math>\pm 3</math> mm</p> <p>&gt; 150 mm to 200mm <math>\pm 4</math> mm</p> <p>JIS G 3192 Leg Length &lt; 50 mm <math>\pm 1.5</math> mm</p> <p>50 to &lt; 100 mm <math>\pm 2</math> mm</p> <p>100 to &lt; 200 mm <math>\pm 3</math> mm</p> <p>200 mm and more <math>\pm 4</math> mm</p> <p>ASTM – A6</p> <p>Leg Length up to 50 mm <math>\pm 1</math> mm</p> <p><math>\geq 50</math> mm to <math>\leq 75</math> mm <math>\pm 2</math> mm</p> <p>&gt; 75 mm to &lt; 100 mm <math>\pm 2</math> mm</p> <p><math>\geq 100</math> mm to <math>\leq 150</math> mm <math>\pm 3</math> mm</p>	<p>(KEC)</p> <p>RY (KEC)</p> <p>RY (KEC)</p>	<p>Record Review</p> <p>Record Review</p>

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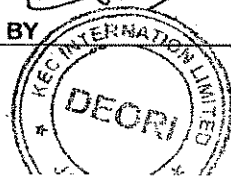


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	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 9 of 22

TITLE :	MANUFACTURING QUALITY PLAN
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Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
IA.1. 8	WEIGHT TOLERANCE FOR ANGLE SECTIONS	One sample for 20 MT per lot or part there of.	BSEN 10056-2 / JIS G 3101 / JIS G 3192  BS 10056-2 ≤4 mm thick - ± 6% > 4 mm thick - +/- 4.0% JIS G 3192 < 10 mm thick - ± 5% 10 mm thick & above - ± 4%  ASTM- A6 - ± 2.5%	QA (KEC)	Record Review
IA.1. 9	THICKNESS TOLERANCE FOR ANGLE SECTIONS	IS 2500 LEVEL – II, AQL – 1.5 as per Table – 1 enclosed.	BSEN 10056-2 / JIS G 3192 / JIS G 3101  BSEN 10056-2 ≤ 5 mm thick - ± 0.5 mm  > 5 to ≤ 10 mm - ± 0.75 mm  > 10 to ≤ 15 mm - ± 1.0 mm  > 15mm - ± 1.20mm  ASTM – A6 <5mm thick - ±0.2mm >5 – 10mm - ±0.3mm	RY (KEC)	Record Review

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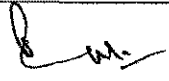
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	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 11 of 22

TITLE : MANUFACTURING QUALITY PLAN

Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
2.0	Cropping (Cutting)	1 <sup>st</sup> piece and subsequently any piece before 50 <sup>th</sup> and so on.	Length tolerance $\pm 2$ mm. The cut surface to be clean, reasonable square & free from distortion.	FAB (KEC)	Record Review
(a)	Stamping	Same as 2.0 (b)	Letter Size 8x16 mm or 8x14 mm	FAB (KEC)	Record Review
(b)	Punching/Drilling	Same as 2.0 (b)	Punching to be done for the thickness up to 12 mm. Drilling to be done for thickness more than 12mm. Holes near bend to be Punched / Drilled after bending. Hole should be perpendicular to surface & difference in dia on both sides of flange should not be more than 0.8 mm	FAB (KEC)	Record Review
(c)	Edge Security	Same as 2.0 (b)		FAB (KEC TL)	Record Review
	(i) For 13.5 mm dia hole		Sheared 20 mm Min. Rolled 16 mm Min.	FAB (KEC)	Record Review
	(ii) For 17.5 mm dia hole		Sheared 23 mm Min. Rolled 20 mm Min.		Record Review
	(iii) For 21.5 mm dia hole		Sheared 28 mm Min. Rolled 25 mm Min.		
	(iv) For 25/25.5mm dia hole		Sheared 38 mm Min. Rolled 33 mm Min.		
(d)	Drilling & Punching Hole to Hole Distance	Same as 2.0 (b)	Tolerance cumulative and between consecutive hole shall be within $\pm 2$ mm and $\pm 1$ mm respectively.	FAB (KEC)	Record Review

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	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
		SHEET NO.	Page 12 of 22
	<b>CUSTOMER-CESC</b>		

<b>TITLE :</b>	<b>MANUFACTURING QUALITY PLAN</b>
----------------	-----------------------------------

Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
(e)	Gauge Distance (Back Mark)	Same as 2.0 (b)	$\pm 1$ mm	FAB (KEC)	Record Review
(f)	Notching, Flange Cut, Corner Cut, Bevel Cut	Same as 2.0 (b)	+ 5 mm on specified length of cut operation by Shearing upto 12 mm thick, and by gas cutting for material above 12mm thick	FAB (KEC)	Record Review
(g)	Heel Grinding	Same as 2.0 (b)	After grinding the thickness on heel should be equal or more than the thickness of the member with + 2 mm and - 0 mm tolerance.	FAB (KEC)	Record Review
(h)	Bending	100 % Pieces	IS 802 Part II IS 7215, Drawing	FAB (KEC)	Record Review
	(i) HT Section/Plates		All sections and all angles to be hot bend		
	(ii) MS Sections		Process Cold Bend : Upto 75x6 - upto 10° Upto 100x8 - upto 5°  All other angle sections and bend angle shall be hot bend.		
	(iii) MS Plates		Cold Bend – upto 12 mm thick (MS) upto 15° angle. Greater bend & other thickness shall be hot bend.		
(i)	Welding	Same as 2.0 (b)	As per KEC Approved Welding Procedure & Welding Qualification.	FAB (KEC)	Record Review

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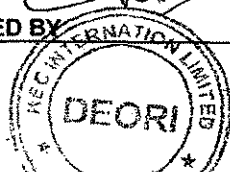
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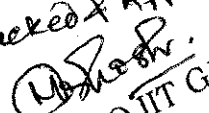
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			REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>		SHEET NO.	Page 13 of 22

TITLE : MANUFACTURING QUALITY PLAN

Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
(j)	Final Inspection of Fabricated Parts	As per Sampling Plan QPM/QA/26	All parameters from (a) to (k) above are checked and records maintained before releasing the materials for galvanizing.	QA (KEC TL)	Record Review
(k)	Proto (Model Assembly as per requirement of the CESC)	One structure of each type	KEC Approved Structural Drawings, Bill of Materials, Tower to be assembled and checked for dimensions, angle, size. By this, to verify interchange ability of members, etc.	R&D (KEC)	Record Review Record Review Record Review Record Review
3.	<b>GALVANIZING</b>				
3.1	<b>PROCESS CONTROL</b>				
(a)	Degreasing in DEOIL solution	One sample daily	Pointage of 10% solution $9 \pm 3$ ML  Temperature of degreaser - Room to $60^{\circ}\text{C}$	QA (KEC)	Record Review
(b)	Pickling				
	(i) Acid Content	One sample daily	IS 2629 50 – 210 Gms/Ltr.	QA (KEC)	Record Review
	(ii) Iron Content	One sample daily	IS 2629 120 Gms/Ltr.Max.		
	(iii) Density	One sample daily	12 to 30 Beaume		
(c)	Rinsing	One sample daily	IS 2629 PH value to be betw-	QA (KEC)	Record Review

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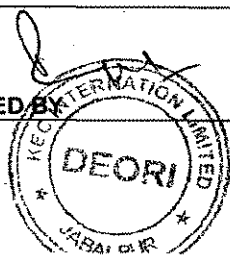
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		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 14 of 22

<b>TITLE :</b> MANUFACTURING QUALITY PLAN
---

Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
(d)	Pre-Fluxing in $ZnCl_2$ and $NH_4Cl$ Solution	One sample daily	IS 2629	QA (KEC)	Record Review
	(i) Iron content		50 Gm/Ltr. Max.		
	(ii) Density in $Be^\circ$		36 to 44 $Be^\circ$		
	(iii) Ph Value		2 to 3		
	(iv) Temperature		Room to 80° C		
(e)	Stripping	One sample daily		QA (KEC)	Record Review
	Density in $Be^\circ$		17 to 45 Beaume		
	Iron Content		25 Gms/Ltr. Max.		
(f)	Pre-heating	Once in a day	IS 2629 120° C to 150° C -Hot Chamber Temp. ( 230° to 330° C )	QA (KEC)	Record Review
3.2	<b>DIPPING (GALV.)</b>				
(a)	Zinc bath temperature continuous recording by graph or manual. Hourly recording and verification by Temperature Meter.	Once in a day.	IS 2629 440° C to 475° C - Galvanizing Working Temperature ( 445° to 465° C )	QA (KEC)	Record Review
(b)	Immersion time and withdrawal time		IS 2629 Article to be immersed till reaction takes place which is indic-	GP (KEC)	

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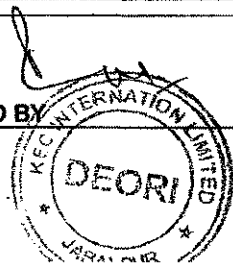
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<b>KEC</b>	<b>KEC INTERNATIONAL LTD., JABALPUR</b>	SECTION	QPM/QA/20
	<b>MANUFACTURING QUALITY PLAN</b>	REV. NO.	01
		REV. DATE	13.08.2010
	<b>CUSTOMER-CESC</b>	SHEET NO.	Page 15 of 22

TITLE : MANUFACTURING QUALITY PLAN

Sl.No.	Component/Operation and Description of Test	Sampling Plan with basis	Reference Document & acceptance norms	Testing Agency	Remarks
(c)	Quenching and Dichromating in running water/Deoxidant	Once daily.	ated by stoppage of bubbling withdrawal to be controlled, so that zinc drains freely. IS 2629 Strength of solutions to be maintained Between 0.2% to 1% Sodium Dichromate. Or as per supplier recommendation	QA (KEC)	Visual Check by colour matching.
3.3	<b>GALVANIZING CHECKING</b>				
(a)	Visual Checking	100 %	IS 2629 Surface to be free from defects like bare / black spots (except when small and suitable for patching) heavy ash & flux inclusion, lumps, pimples, runs, etc.	GP (KEC)	Record Review
(b)	Thickness of Zinc Coating	Eight Samples per Shift	IS 2629 / IS4759/ BS 729 Material <5mm thick 65 Microns min average. 5mm thick & above 86 Microns min average ASTM A 123 : ≤3.2mm- 65 Microns (Average) >3.2 to 6.4 mm - 85 Microns (Average) >6.4 mm - 100 Microns (Average)	KEC (QA)	Record Review
(c)	Weight of Zinc Coating	Three Samples per Shift	IS 2629 / IS 4759 / IS 6745 / BS 729	QA (KEC)	Record Review

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